HW due Thurs

day 38

3.7/ 97-98

3.8/ 26-27, 37-38, 51

3.9/ 1-8

due Fri 3.8/ 52-53, 59, 69, 81

3.9/ 9-12, 23-24, 34-35, 45-46

day 38

3.7/79 $h(x)=f(g(x))$ [[f, g differentiable where defined]]

eq^n of line tangent to graph of g at (4, 7) is $y=3x-5$

" " " " f at (7, 9) is $y=-2x+23$

$h(4)=f(g(4))=f(7)=9$

$h'(4)=h'(x)\Big|_{x=4}=\frac{d}{dx}\left(f(g(x))\right)\Big|_{x=4}=f'(g(x))\cdot g'(x)\Big|_{x=4}$

$=f'(g(4))\cdot g'(4)=f'(7)\cdot g'(4)$

$=(-2)(3)=-6$

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day 38

3.7/79

$h(x) = f(g(x))$

$y = 3x - 5 \Rightarrow$ For line tan to graph of g

$y = -2x + 23 \Rightarrow$ For line tan to graph of f

$h(x) = f(g(x)) = -2(3x-5) + 23 = -6x + 10 + 23 = \boxed{-6x+33}$

$h'(x) = \frac{d}{dx}(33) - \frac{d}{dx}(6x) = -6$

$h(4) = -6(4) + 33 = -24 + 33 = 9$

$h'(4) = -6$

slope $= -6$ pt $= (4, 9)$

$y - 9 = -6(x - 4)$

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3.8/14)

$$e^{xy} = 2y$$

diff imp

$$\frac{d}{dx}\left(e^{xy}\right) = \frac{d}{dx}(2y)$$

$$= e^{xy} \cdot \frac{d}{dx}(xy) = 2\frac{dy}{dx}$$

$$= e^{xy}\left[\frac{d}{dx}(x)\cdot y + x\frac{d}{dx}(y)\right] = 2\frac{dy}{dx}$$

$$\left[y + x\frac{dy}{dx}\right]$$

NOTE

$$= ye^{xy} + xe^{xy}\frac{dy}{dx} = 2\frac{dy}{dx}$$

$$\text{So } xe^{xy}\frac{dy}{dx} - 2\frac{dy}{dx} = -ye^{xy}$$

$$\frac{dy}{dx}\left(xe^{xy} - 2\right) = -ye^{xy}$$

$$\frac{dy}{dx} = \frac{-ye^{xy}}{xe^{xy} - 2}$$

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day 38

NLP - neuro-linguistic programming

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day 38

3.8/31) $x + y^2 = 1$ find $\frac{d^2y}{dx^2}$

first deriv

$\frac{d}{dx}(x) + \frac{d}{dx}(y^2) = \frac{d}{dx}(1)$

$1 + 2y \cdot \frac{d}{dx}(y) = 0$

$1 + 2y\frac{dy}{dx} = 0 \Longrightarrow \frac{dy}{dx} = \frac{-1}{2y}$

second deriv

$\frac{d}{dx}(1) + 2\frac{d}{dx}\left(y\frac{dy}{dx}\right) = \frac{d}{dx}(0)$

$2\left[\frac{d}{dx}(y)\cdot\frac{dy}{dx} + y\frac{d}{dx}\left(\frac{dy}{dx}\right)\right] = 0$

$\frac{2}{2}\left[\left(\frac{dy}{dx}\right)^2 + y\frac{d^2y}{dx^2}\right] = \frac{0}{2}$

$\left(\frac{dy}{dx}\right)^2$ = square first deriv

$y\frac{d^2y}{dx^2} = -\left(\frac{dy}{dx}\right)^2 \Rightarrow \frac{d^2y}{dx^2} = -\frac{1}{y}\left(\frac{dy}{dx}\right)^2$

$\frac{d^2y}{dx^2} = -\frac{1}{y}\left(\frac{-1}{2y}\right)^2$

$\frac{d^2y}{dx^2}$ = the second derivative

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3.8/131

day 38

$\sin(xy) = x + y$ chercher $\frac{dy}{dx}$

$$\frac{d}{dx}(\sin(xy)) = \frac{d}{dx}(x+y)$$

$$\frac{d}{dx}(\sin x)\Big|_{\substack{\text{where}\\ x=xy}} \cdot \frac{d}{dx}(xy) = \frac{d}{dx}(x) + \frac{d}{dx}(y)$$

$$\cos(xy)\cdot\left[\frac{d}{dx}(x)\cdot y + x\frac{d}{dx}(y)\right] = 1 + \frac{dy}{dx}$$

$$\cos(xy)\left[y + x\frac{dy}{dx}\right] = 1 + \frac{dy}{dx}$$

wave hands

$$x\cos(xy)\frac{dy}{dx} - \frac{dy}{dx} = 1 - y\cos(xy)$$

$$\frac{dy}{dx}(x\cos(xy) - 1) = 1 - y\cos(xy)$$

$$\frac{dy}{dx} = \frac{1 - y\cos(xy)}{x\cos(xy) - 1}$$

day 38

3.7/80) $f(x)$ differentiable, $f(1)=4$

$g(x)=f(x^2)$

the line tangent to $f(x)$ at $(1,4)$ is

$3x+1$ [[i.e. $f'(1)=3$]]

$g(1)=f(1^2)=f(1)=4$

$g'(x)=\frac{d}{dx}f(x^2)=f'(x^2)\cdot\frac{d}{dx}(x^2)=2xf'(x^2)$

$g'(1)=2(1)f'(1)=6$

eqn(slope=6, pt=(1,4)) . . . .

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